

What is claimed is:

1. An authentication processing system, comprising:

a portable information terminal;

a terminal authentication apparatus which conducts authentication processing by air; and

an operation apparatus which conducts a prescribed operation when said terminal authentication apparatus has succeeded in authentication with said portable information terminal,

wherein said portable information terminal includes:

an existence confirmation signal transmission unit configured to transmit an existence confirmation signal to confirm whether or not said terminal authentication apparatus exists, at a first time interval;

an existence notice signal reception unit configured to receive an existence notice signal transmitted from said terminal authentication apparatus in response to said existence confirmation signal;

a first link connection unit configured to establish a wireless link with said terminal authentication apparatus which has transmitted said existence notice signal when said existence notice signal is received; and

a first authentication unit configured to conduct a first authentication with said terminal authentication apparatus through said wireless link,

wherein said terminal authentication apparatus includes:

an existence confirmation signal reception unit set to a reception mode capable of receiving said existence confirmation signal at a second time interval only during a third time interval equal to or longer than said first time interval;

an existence notice signal reception unit configured to transmit said existence notice signal serving as response of said existence confirmation signal to said portable information terminal when said existence confirmation signal is received;

a second link connection unit configured to establish a wireless link with said portable information terminal after said

portable information terminal receives said existence notice signal;

a second authentication unit configured to conduct said first authentication with said portable information terminal through said wireless link; and

a control command transmission unit configured to transmit a control command for said operation apparatus when said first and second authentication units succeed in said first authentication,

wherein said operation apparatus includes:

a control command reception unit configured to receive said control command; and

an operation conduction unit configured to conduct said prescribed operation based on said control command.

2. The authentication processing system according to claim 1, wherein radio wave arrival ranges of said existence confirmation signal and said existence notice signal are longer than a distance obtained by multiplying a sum of said first and second time intervals by an average moving speed of said portable information terminal.

3. The authentication processing system according to claim 1, wherein at least one of said portable information terminal and said terminal authentication apparatus has a distance detection unit configured to detect a distance between said portable information terminal and said terminal authentication apparatus; and

said control command transmission unit transmits said control command to said operation apparatus when said first authentication is succeeded and the distance between said portable information terminal and said terminal authentication apparatus is equal to or less than a prescribed value.

4. The authentication processing system according to claim 3, wherein said distance detection unit detects the distance based on field intensity of radio wave transmitted between said portable

information terminal and said terminal authentication apparatus.

5. The authentication processing system according to claim 1, wherein at least one of said terminal authentication apparatus and said operation unit has an approach detector which detects that said portable information terminal or a user thereof has approached; and

said operation conduction unit conducts said prescribed operation when said first authentication is succeeded and said control command is received by said control command reception unit, and said approach detector has detected approach within a prescribed distance.

6. The authentication processing system according to claim 5, wherein said approach detector is a contact detection sensor which detects that the user of said portable information terminal has contacted said terminal authentication apparatus or said authentication operation conduction apparatus.

7. The authentication processing system according to claim 5, wherein at least one of said portable information terminal and said terminal authentication apparatus has an interval controller which controls at least one of said first, second and third time intervals so that said third time interval is longer than said first time interval.

8. The authentication processing system according to claim 5, wherein at least one of said portable information terminal and said terminal authentication apparatus has a battery monitor which detects remaining electric capacity of a battery; and

said interval controller controls at least one of said first, second and third time intervals so that said first and second time intervals are equal to each other, or said third time interval is longer than said first time interval, in accordance with the remaining electric capacity of the battery detected by said battery monitor.

9. The authentication processing system according to claim 8, wherein at least one of said portable information terminal and said terminal authentication apparatus has a time measurement unit configured to measure a time elapsed from when it became impossible to detect a communication partner, or a time elapsed from when the wireless link with said terminal authentication apparatus is cut off; and

said interval controller controls at least one of said first, second and third time intervals so that said first and second time intervals are equal to each other, or said third time interval is longer than said first time interval.

10. The authentication processing system according to claim 1, wherein said portable information terminal has a third authentication unit configured to conduct a second authentication with said terminal authentication apparatus after said terminal authentication apparatus has transmitted said control command to said operation apparatus; and

said terminal authentication apparatus has a fourth authentication unit configured to conduct said second authentication with said portable information terminal after transmitting said control command to said operation apparatus.

11. The authentication processing system according to claim 10, wherein said first authentication is a link authentication of Bluetooth; and

said second authentication is an authentication by an authentication protocol upper than a link of Bluetooth.

12. The authentication processing system according to claim 1, wherein said prescribed operation is to lock and unlock a door of a vehicle.

13. An authentication apparatus, comprising:  
an existence confirmation signal receiver which in order

to receive an existence confirmation signal outputted from a portable information terminal at a first time interval, is set to a reception mode capable of receiving said existence confirmation signal at a second time interval, only during a third time interval equal to or longer than said first time interval;

an existence notice signal transmitter which transmits said existence notice signal serving as response of said existence confirmation signal to said portable information terminal when said existence notice signal is received;

a link connection unit configured to establish a wireless link with said portable information terminal after said existence notice signal has been received by said portable information terminal;

an authentication unit configured to conduct authentication with said portable information terminal through said wireless link; and

a control command transmitter which transmits a control command when said authentication has been succeeded.

14. The authentication apparatus according to claim 13, further comprising a distance detection unit configured to detect a distance between said portable information terminal and said terminal authentication apparatus,

wherein said control command transmission unit transmits said control command to said operation apparatus when said first authentication is succeeded and the distance between said portable information terminal and said terminal authentication apparatus is equal to or less than a prescribed value.

15. The authentication apparatus according to claim 13, further comprising an interval controller which controls at least one of said first, second and third time intervals so that said third time interval is longer than said first time interval.

16. The authentication apparatus according to claim 15, further comprising a battery monitor which detects remaining electric

capacity of a battery,

wherein said interval controller controls at least one of said first, second and third time intervals so that said first and second time intervals are equal to each other, or said third time interval is longer than said first time interval, in accordance with the remaining electric capacity of the battery detected by said battery monitor.

17. The authentication apparatus according to claim 16, further comprising a time measurement unit configured to measure a time elapsed from when it became impossible to detect a communication partner, or a time elapsed from when the wireless link with said terminal authentication apparatus is cut off,

wherein said interval controller controls at least one of said first, second and third time intervals so that said first and second time intervals are equal to each other, or said third time interval is longer than said first time interval.

18. The authentication apparatus according to claim 13, wherein said prescribed operation is to lock and unlock a door of a vehicle.

19. An authentication processing method of an authentication processing system comprising a portable information terminal; a terminal authentication apparatus which conducts authentication processing by air; and an operation apparatus which conducts a prescribed operation when said terminal authentication apparatus has succeeded in authentication with said portable information terminal,

wherein said portable information terminal includes:

transmitting an existence confirmation signal to confirm whether or not said terminal authentication apparatus exists, at a first time interval;

receiving an existence notice signal transmitted from said terminal authentication apparatus in response to said existence confirmation signal;

establishing a wireless link with said terminal

authentication apparatus which has transmitted said existence notice signal when said existence notice signal is received; and

conducting a first authentication with said terminal authentication apparatus through said wireless link,

wherein said terminal authentication apparatus includes:

setting to a reception mode capable of receiving said existence confirmation signal at a second time interval only during a third time interval equal to or longer than said first time interval;

transmitting said existence notice signal serving as response of said existence confirmation signal to said portable information terminal when said existence confirmation signal is received;

establishing a wireless link with said portable information terminal after said portable information terminal receives said existence notice signal;

conducting the authentication with said portable information terminal through said wireless link; and

transmitting a control command for said operation apparatus when the authentication is succeeded,

wherein said operation apparatus includes:

receiving said control command; and

conducting said prescribed operation based on said control command.

20. An authentication processing program, allows a computer to execute the steps of:

in order to an existence confirmation signal outputted from a portable information terminal at first time interval, setting to a reception mode capable of receiving said existence confirmation signal at a second time interval only during a third time interval equal to or longer than said first time interval;

transmitting said existence notice signal serving as response of said existence confirmation signal to said portable information terminal when said existence confirmation signal is received;

establishing a wireless link with said portable information terminal after said portable information terminal receives said existence notice signal;

conducting the authentication with said portable information terminal through said wireless link; and

transmitting a control command for said operation apparatus when the authentication is succeeded, in order to allow said operation apparatus to conduct a prescribed operation.